

CLAIMS

1. A device comprising a combination of a chamber and a piston positioned inside the chamber, said chamber and said piston relatively movable to each other in a predetermined direction of movement between a first position and a second position,

characterized by the fact that

- the cross-section of the chamber (1,21,60,70,90,169,216,231) in a plane perpendicular to the direction of movement is larger at the first position than at the second position,

- the change (16,17,18,66,67,68,69,72,74,151,153,159,160,161) of the cross-section of the chamber (1,21,60,70,90,169,216,231) is essentially continuous between the first position and the second position, and

- the cross-section of the piston (20,20',36,36',49,49',50,50',59,59',76,76',92,92',118,118',138,138',146,146',168,168',189,189',208,208',222,222',222'') is arranged to adapt itself to the cross-section of the chamber (1,21,60,70,90,169,216,231).

2. A device comprising a combination of a chamber and a piston positioned inside the chamber, the chamber and the piston relatively movable to each other in a predetermined direction of movement between a first position and a second position,

characterized by the fact that

- the cross-section of the piston (230) in a plane perpendicular to the direction of movement is larger at a first piston position than at a second piston position,

- the change of the cross-section of the piston (230) is essentially continuous between the first piston position and the second piston position,

- the cross-section of the chamber (231) in a plane perpendicular to the direction of movement is larger at the first position than at the second position,

- the change of the cross-section of the chamber is essentially continuous between the first position and the second position and

- the cross-section of the chamber (231) is arranged to adapt itself to the cross-section of the piston (230).

3. A device comprising a combination of a chamber and a piston positioned inside the chamber, said chamber and said piston relatively movable to each other in a predetermined direction of movement between a first position and a second position,

characterized by the fact that

- the cross-section of the piston (20,20',36,36',49,49',50,50',59,59',76,76',92,92',118,118',138,138',146,146',168,168',189,189',208,208',222,222',222'') in a plane perpendicular to the direction of movement is larger at a first piston position than at a second piston position,
- the change of the cross-section of the piston (20,20',36,36',49,49',50,50',59,59',76,76',92,92',118,118',138,138',146,146',168,168',189,189',208,208',222,222',222'') is essentially continuous between the first piston position and the second piston position,
- the cross-section of the chamber (231) in a plane perpendicular to the direction of movement is larger at the first position than at the second position,
- the change of the cross-section of the chamber (231) is essentially continuous between the first position and the second position and
- a cross-section of the chamber (231) and the piston (20,20',36,36',49,49',50,50',59,59',76,76',92,92',118,118',138,138',146,146',168,168',189,189',208,208',222,222',222'') respectively is arranged to adapt itself to the cross-section of the piston (20,20',36,36',49,49',50,50',59,59',76,76',92,92',118,118',138,138',146,146',168,168',189,189',208,208',222,222',222'') and the chamber (231), respectively.

4. A device comprising a combination of a chamber and a piston according to claim 1, 2 or 3 **characterized by the fact that** the circumference of the cross-section perpendicular to the direction of movement of the chamber (162) and/or the piston (163) at at least one part of said chamber and/or said piston, is constant between and including said first position and said second position.

5. A device comprising a combination of a chamber and a piston according to claim 4, **characterized by the fact that** said cross-section

- consisting of sectors (152,154), wherein in each sector the distance between the centerpoint of the cross-section of the chamber (162) and the outermost limiting surface of the chamber is larger than the corresponding distance measured along a line separating the sector from an adjacent sector, and
- the change (151,153) of the shape between two adjacent sectors is essentially continuous.

6. A device comprising a combination of a chamber and a piston according to claim 1, 2 or 3, **characterized by the fact that** the cross-section of the chamber (1,21,60,70,90,169,216,231) is circular at any point between and including the said first position and second position.

7. A device comprising a combination of a chamber and a piston according to claim 1, 2 or 3, **characterized by the fact that** the piston comprises a sealing portion (8,8',20,20',25,25',36,36',40,40',41,41',48,49,49',50,50',58,59,59',76,76',80,80',83,92,92',102,102',112,117,118,118',129,133,138,138',146,146',167,167',168,168',185,188,189,189',198,198',208,208',209,220,220',222,222',222'',235) made of an elastically deformable material and/or a loading portion (9,9',31,42,51,54,54',100,101,103,103',124,124',130,131,136,137,173,173',174,174',181,205,205',206,215,215',219,219',232,233,237) and/or a support portion (10,28,31,42,43,84,184).

8. A device comprising a combination of a chamber and a piston according to claim 7, **characterized by the fact that** the sealing portion ((8,8',25,185,209,79,80,80',130,131,132,133,170,171,172,190) in cross-section of the piston (20,20',36,36',59,59',76,76',189,189',146,146',168,168',208,208',222,222',222'')) parallel to the direction of movement has a general form of an area which is bound by a curve and/or line with specific predetermined mathematical characteristics in which the said adaptation of the cross-section of said piston in a plane perpendicular to the direction of movement corresponds to a change in a value of a characteristic in a direction perpendicular and/or in a direction of the movement of said piston and/or said chamber (1,21,60,70,90,162,169,216,231).

9. A device comprising a combination of a chamber and a piston according to claim 8, **characterized by the fact that** the sealing portion (25) in a cross-section of the piston (36,36') in a plane parallel to the direction of movement has the general form of an area bounded by a rectangular having a predetermined length of its sides, in which the said adaptation of the cross-section of the piston (36,36') in a plane perpendicular to the direction of movement corresponds to a change in the length of a side of said rectangular perpendicular to the direction of movement and is accompanied by an opposite change in the length of a side along the direction of movement.

10. A device comprising a combination of a chamber and a piston according to claim 9, **characterized by the fact that** the change of the length of said side along the direction of movement is accompanied by a change in the shape of said rectangular.

11. A device comprising a combination of a chamber and a piston according to claim 8, **characterized by the fact that** the sealing portion (8,8',80,80',185,209) in a cross-section of the piston (20,20',59,59',189,189') in a plane parallel to the direction of movement has the general form of the obliques of a triangle of which its perpendicular being parallel with the direction of movement, the obliques of the said triangle extending outwards from the said perpendicular in a predetermined angle (α_1, ϵ_1), wherein the said adaptation of the cross-section of the piston (20,20',59,59',189,189') in a plane perpendicular to the direction of movement corresponds to a change in the said predetermined angle (α_2, ϵ_2).

12. A device comprising a combination of a chamber and a piston according to claim 8, **characterized by the fact that** the sealing portion (79,80) in a cross-section of the piston (76,76') in a plane parallel to the direction of movement has the general form of an area which is bound by a approximately a triangle, a perpendicular being parallel to the direction of movement and the obliques of the said triangle extending outwards from the said perpendicular in a predetermined angle ϕ_1 , wherein the said adaptation of the cross-section of the piston in a plane perpendicular to the direction of movement corresponds to a change in the said predetermined angle ϕ_2 .

13. A device comprising a combination of a chamber and a piston according to claim 11 or 12, **characterized by the fact that** the said predefined angle ($\alpha_1, \epsilon_1, \phi_2$) is larger at the first position than at the said second position.

14. A device comprising a combination of a chamber and a piston according to claim 8, **characterized by the fact that** the sealing portion (130,131,132,133,170,171,172,190) in a cross-section of the piston (146,146',168,168',208,208') in a plane parallel to the direction of movement has the general form of an area which is bound by a circle having a predetermined radius, a central axis parallel to the direction of movement and, wherein the said adaptation of the cross-section of the piston (146,146',168,168',208,208') in a plane perpendicular to the direction of movement corresponds to a change in the said radius.

15. A device comprising a combination of a chamber and a piston according to claim 14, **characterized by the fact that** the said adaptation is accompagnied by an opposite change of the radius in the direction of movement.

16. A device comprising a combination of a chamber and a piston according to claim 8, **characterized by the fact that** the sealing portion in a cross-section of the piston (222,222', 222'') in a plane parallel to the direction of movement has the general form of an area which is bounded by a rhomboid, which has a predetermined length of its axis, one of the axis parallel to the direction of movement, wherein said adaptation of the cross-section of the piston in a plane perpendicular to the direction of movement corresponds with a change in the length of an axis and an opposite change in the length of the other axis.

17. A device comprising a combination of a chamber and a piston according to claim 8, **characterized by the fact that** the sealing portion in a cross-section of the piston (222,222', 222'') in a plane parallel to the direction of movement has the general form of an area which is bounded by an ellipse, which has a predetermined length of its axes, one of the axis parallel to the direction of movement, wherein said adaptation of the cross-section of the piston in a plane perpendicular to the direction of movement corresponds with a change in the length of an axis and an opposite change in the length of the other axis.

18. A device comprising a combination of a chamber and a piston according to claim 8, **characterized by the fact that** the sealing portion in a cross-section of the piston (92,92') in a plane parallel to the direction of movement comprises parts (X,Y,Z) which are preformed, having in between predetermined angles (κ_1, λ) where said part X having a predetermined angle η_1 with the direction of movement wherein said adaptation of the cross-section of the piston in a plane perpendicular to the direction of movement corresponds with a change in said angles (κ_2, η_2).

19. A device comprising a combination of a chamber and a piston according to claim 7, **characterized by the fact that** said sealing portion comprise a sealing edge (48,58,83,102, 102',117,129,167,167',188,198,198',220,220',235) which is engaging the wall (2,3,4,5,61, 62,63,64,65,155,156,157,158,207,238) of said chamber (1,21,60,70,90,169,216,231), wherein said adaptation additionally is accompanied by a change in the size and/or shape of said sealing edge under the influence of said loading means.

20. A device comprising a combination of a chamber and a piston according to claim 19, **characterized by the fact that** said loading means provides a spring-force to the sealing edge

(48,58,83,102,102',117,129,167,167',188,198,198',220,220',235) so that said piston (20,20',36,36',49,49',50,50',59,59',76,76',92,92',118,118',138,138',146,146',168,168',189,189',208,208',222,222',222'') engages the wall (2,3,4,5,61,62,63,64,65,155,156,157,158,207,238) of the chamber (1,21,60,70,90,169,216,231) with a sealing force.

21. A device comprising a combination of a chamber and a piston according to claim 20, **characterized by the fact that** said loading means comprise

- a medium (103,103',124,124',136,137,173,173',174,174',205,205',206,215,215',219',232,233,237),
 - a layer of fibers (111,130,171) which can freely shear over each other or a layer of a reinforcement (51,100),
 - said fibers are embedded in a skin (110,110',170,170') made of rubber or a thermoplast,
 - positioned inside said piston (92,92',146,146',168,168',208,208',222,222',222'')
- and/or inside the wall (238) of the chamber (231) which has a predetermined pressure at said first position, and which can have a different pressure at said second position.

22. A device comprising a combination of a chamber and a piston according to claim 19 or 20 in which the said piston is connected to the piston rod for moving the piston in the direction of movement **characterized by the fact that** said piston (92,146,168,208,222) and/or said chamber (231) comprise loading regulating means (103,110,123,124,125,126,127,137,138,139,140,141,-145,170,173,177,178,179,199,200,201,206,215,223,224,232) providing a sealing force
- which adjust itself so that the sealing edge (102,102',129,129',167,167',198,198',220,220',235) seals against the wall of the chamber during said movement between and including said first position and said second position, and
 - said sealing force depends on the relative position of said piston and said chamber and/or on the pressure of a medium in the chamber, and/or the operating force, and/or a spring-force.

23. A device comprising a combination of a chamber and a piston according to claim 22 in which the said piston is connected to a piston rod for moving the piston in the direction of movement, **characterized by the fact that**
- the piston rod (120,195) of the piston (146,208) comprises a channel (125) which is connected by a hole (123,199,200,201) in the wall of said piston rod to a medium (124,205,206) of the piston (146,208), so that a medium can be conducted through said hole (123,199,200,201),

- said channel (125) comprises a piston (126) which is engaging said medium by a spring-force.

24. A device comprising a combination of a chamber and a piston according to claim 22 in which the said piston is connected to a piston rod for moving the piston in the direction of movement, **characterized by the fact that**

- the piston rod (140) of said piston comprises a channel which is connected by a hole (199,200,201) in the wall of said piston rod to a medium (136,137) of the piston, so that a medium can be conducted through said hole (199,200,201),

- a cap which is connecting the piston to said piston rod (140) comprises a stop (145) for preventing said piston to disassemble from said piston rod (140), and

- said channel comprises a piston (138) which is engaging said medium (136,137) by the operational force.

25. A device comprising a combination of a chamber and a piston according to claim 22 in which the said piston is connected to a piston rod for moving the piston in the direction of movement, **characterized by the fact that**

- the piston rod (224) of the piston (222) comprises a channel (221) which is connected by a hole in the wall of said piston rod to a medium (215,219) of the piston (222), so that a medium can be conducted through said hole,

- said channel (221) comprises a piston (149) which is engaging said medium by a spring-force of a piston (148) which is connected by a piston rod (217), and which is engaged by a medium in the chamber (216).

26. A device comprising a combination of a piston and a chamber according to claim 1, 2 or 3 in which the said piston is connected to the piston rod for moving the piston in the direction of movement, **characterized by the fact that** said piston (168,168',208,208',222,222',222'') and/or chamber (231) comprise shape regulating means (177,179,191,192,202,203,196,197,211,-212,213,214).

27. A device comprising a combination of a piston and a chamber according to claim 26, **characterized by the fact that**

- a cap (177,191,192,211,212,213,214) is movable over the piston rod (176,195,224) in a predetermined direction,

- defined by a stop (196,197) or a cap (175) which is fastened to the piston rod (176),
- a sealing device (172) and/or an impervious layer (190) which is tightly squeezed between the skin (170) and said caps (191,192,211,212,213,214) and sealing device (202,203) prevent the medium or media to escape from the piston (168,168',208,208',222,222',222'').

28. A device comprising a combination of a piston and a chamber according to claim 27, **characterized by the fact that** said movement is

- damped by a spring (178), and
- is limited by a stop (179).

29. A combination of a piston and a chamber according to claim 1, 2 or 3 in which the said piston is connected to a piston rod for moving the piston in the direction of movement, **characterized by the fact that the**

- piston rod (6,23) comprises an inlet and a channel (12) for conducting pumped gaseous and/or liquid media into the chamber (1,21,60,70,231), and
- the piston rod (6,23) further comprises a valve (13) for preventing the pumped gaseous and/or liquid media from escaping the chamber (1,21,60,70,231) through the said channel (12).

30. A combination of a piston and a chamber according to claim 1, 2 or 3 **characterized by the fact that**

- the chamber (90) comprise an inlet channel (94) for conducting pumped gaseous and/or liquid media into said chamber (90), wherein said inlet channel (96) comprises a valve for preventing the pumped gaseous and/or liquid media from escaping the chamber through said inlet channel (91).

31. A device comprising a combination of a chamber and a piston according to claim 1, 2 or 3, in which the chamber comprises an outlet channel and/or an inlet channel for conducting pumped gaseous and/or liquid media out of the chamber, **characterized by the fact that** the second position is closer to the outlet channel (14,77,93) than the first position, so that the cross-section of the chamber (1,21,60,70,90,162,169,216,231) diminishes from the first position towards the second position.

32. A device comprising a combination of a chamber and a piston according to claim 31,

characterized by the fact that said outlet channel (93) comprises a valve for preventing the pumped gaseous and/or liquid media to be conducted into said chamber.

33. A device comprising a combination of a chamber and a piston according to claim 1,2 or 3 in which the said piston is connected to a piston rod for moving the piston in the direction of movement, **characterized by the fact that** said chamber is closed and comprises a medium which is non-compressable, while said piston comprises valve means for conducting the said medium.

34. A device comprising a combination of a chamber and a piston according to claim 1,2 or 3 in which said piston is connected to a piston rod for moving the piston in the direction of movement, **characterized by the fact that** said chamber is closed and comprises a medium which is compressable between said piston and a wall of said chamber.

35. A device comprising a combination of a chamber and a piston according to claim 1,2 or 3 in which said piston is connected to a piston rod for moving the piston in the direction of movement, **characterized by the fact that** said device comprises valve means and valve regulating means in order to selectively conduct a medium in or out of the space between said piston and said chamber.

36. A device comprising a combination of a chamber and a piston according to claim 1,2 or 3 in which said piston is connected to a piston rod for moving the piston in the direction of movement, **characterized by the fact that** said chamber or said piston is connected to an axis in order to transform the translation of the piston and/or the chamber into a rotation, where the chamber comprises valve means and valve regulating means for selectively conducting and not conducting a medium to the space between the said piston and said chamber in order to move said chamber and/or piston.

37. A device comprising a combination of a piston and a chamber according to claim 22 **characterized by the fact that** the pressure inside the piston and/or inside the wall of the chamber is higher, equal or lower than the pressure in the chamber.

38. A device comprising a combination of a piston and a chamber according to claim 22, **characterized by the fact that** the pressure inside the piston is higher, equal or lower than than the pressure in the wall of the chamber.

39. A device comprising a combination of a piston and a chamber according to claim 37 or 38, **characterized by the fact that** the piston and/or the chamber comprise supporting means.

10

15

20

25

30